SANDAKANIA 7 (1996): 49–58

Temburongia, a new genus of bamboo (*Gramineae : Bambusoideae*) from Brunei

Soejatmi Dransfield[1] **& K.M. Wong**[2]

[1] Royal Botanic Gardens Kew,
Richmond, Surrey, TW9 3AE, England

[2] Forest Research Centre, Sepilok,
P.O. Box 1407, 90715 Sandakan,
Sabah, Malaysia

Summary. A new genus of bamboo (Gramineae – Bambusoideae), *Temburongia*, is described from Brunei, with a single species *T. simplex*. The morphology of the vegetative parts and the inflorescence is discussed. The inflorescence is determinate, as buds do not occur at the base of spikelets, but the main axis is clearly segmented, and sheaths or bracts and prophylls are present in the inflorescence.

In 1988 a sterile scrambling bamboo was collected for the first time from Kuala Belalong, Temburong, Brunei Darussalam (*Wong s.n.*). At that time it was clear that the species was undescribed and it was also not possible to assign it to any genus. The culm nodes develop a circumaxial ridge, or patella. The leaf-blades have peculiar stiff, linear auricles (Fig. 1: F1 & F2). In 1989, during the first joint expedition under the Forestry Department, Brunei Darussalam and the Royal Botanic Gardens, Kew (U.K.) collaborative agreement, flowers of this bamboo were collected from the clump growing near the camp at Kuala Belalong on the Temburong River (this camp site is now the headquarters of the Ulu Temburong National Park). Subsequent research has shown that it belongs to a new undescribed genus, for which we propose the name *Temburongia*. Later, more flowering material was found in scattered populations along the river. Since then many more collections have been made. The inflorescences are up to 5 cm long, and are borne terminally on leafy branches. The main inflorescence axis is clearly segmented. Each branch of the main inflorescence axis bears 1–3 sessile spikelets, each having one fertile floret which easily falls off at maturity. The leafy branches bearing inflorescences are borne at nodes of the upper part of the scrambling culms or branches, often hanging over the river. This bamboo grows in primary

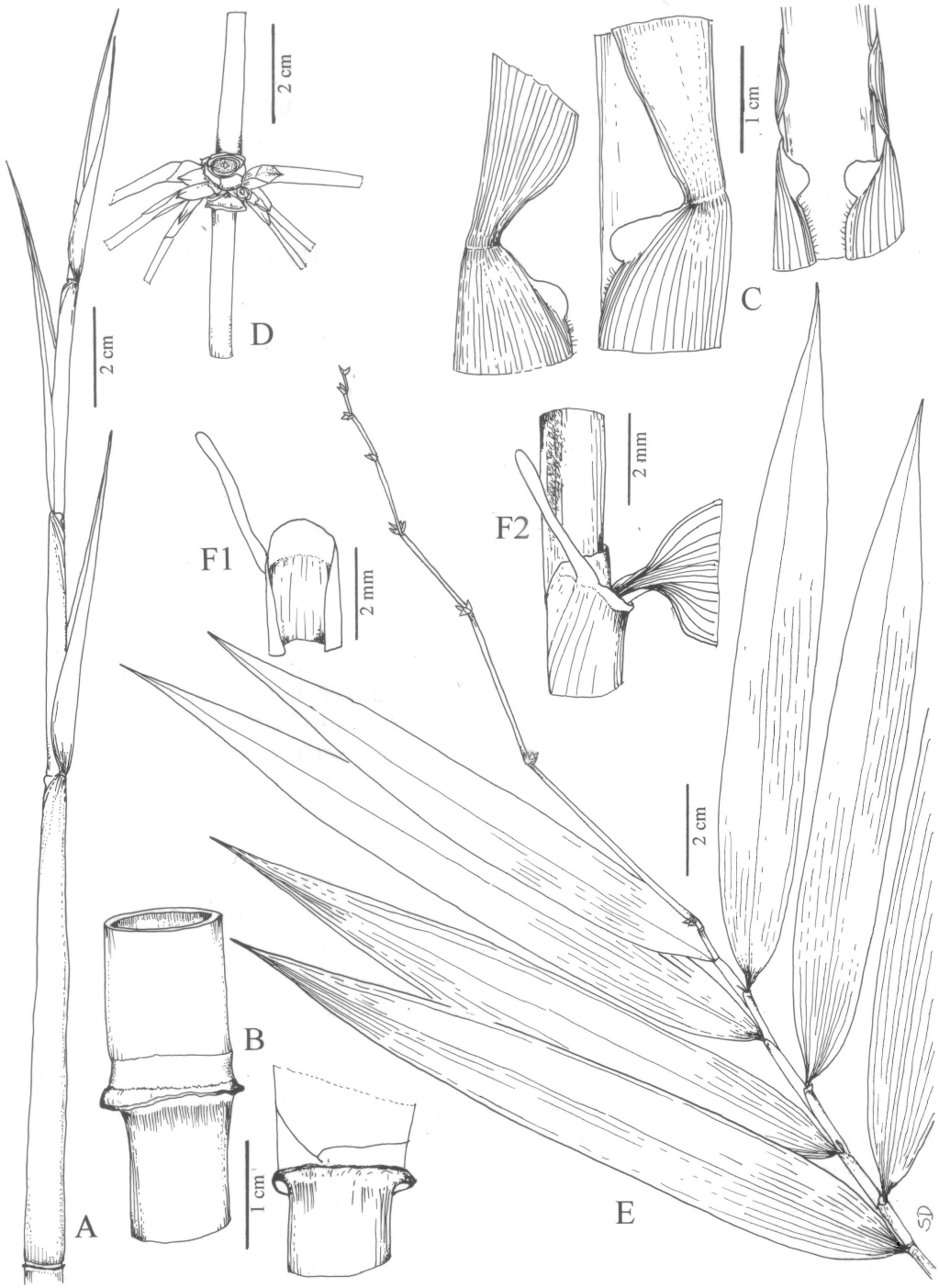

Fig. 1. *Temburongia simplex.* **A.** Young shoot. **B.** Portions of culm showing nodes with patella. **C.** Culm-sheath auricles. **D.** Structure of the branch complement. **E.** Leafy flowering branch, the spikelets fallen away. **F 1 & 2.** Leaf-blade auricles and ligule. **A & B** from *Wong s.n., 22 July 1988*, **C** from SD 1200, **D & E** from SD 1234, **F & G** from SD 1014. (Drawn by S. Dransfield.)

forest around Sungai (River) Belalong up to Bukit Belalong (i.e., Belalong Hill) along Sungai Temburong and near Selapon, also in Temburong District.

The inflorescence structure in *Temburongia*

Because the ultimate axes bearing the spikelets are short and such spikelet-bearing branchlets are, in effect, clustered together, superficially it looks as if the inflorescence is of an indeterminate nature, i.e., a cluster of such short spikelet-bearing branches at a node on the main inflorescence axis resembles a pseudospikelet cluster. Furthermore the spikelets are sessile, like those of *Bambusa* Schreb. or *Schizostachyum* Nees, which have indeterminate inflorescences. In mature spikelets the rachis internode below the fertile floret elongates considerably so as to expose this floret together with the extraordinarily long rachilla extension bearing a rudimentary floret, like that of the spikelet of *Schizostachyum*. After careful examination, it is found that the inflorescence in the new bamboo is determinate in its branching habit, with the presence of prophylls.

When McClure (1966) proposed the terms semelauctant (for an inflorescence of determinate nature) and iterauctant (for an inflorescence of indeterminate branching), he explained that the differences between them lay mainly in the structure of the basic unit of the inflorescence. In semelauctant inflorescences the basic unit is the spikelet; in interauctant inflorescences, it is termed pseudospikelet. He explained further that in the iterauctant inflorescence, all axes of the branches are clearly segmented and bear a sheathing organ at each node, each branch possessing a prophyll at the base. In semelauctant inflorescences, on the other hand, the branch portion below the spikelet is not or only weakly segmented, the sheathing organs are absent or only rudimentary, and prophylls are usually absent. However, McClure noted exceptions; for example, two genera, *Glaziophyton* Franch. and *Greslania* Balansa, have semelauctant inflorescences, for their basic unit is a spikelet, but all axes are segmented and bear a sheathing organ at each node. This type of semelauctant inflorescence is, in fact, not so common in bamboos, and is found in the genus *Hickelia* A. Camus from Madagascar and East Africa (Dransfield 1994), and *Nastus hooglandii* Holttum from New Guinea (Dransfield, unpubl.). The structure of the inflorescence in *Temburongia* is basically similar to that of the above genera. Here the main inflorescence axis is clearly segmented, and consists of 3–5 internodes. Each node of this main inflorescence axis bears a sheath (with or without reduced blade) subtending a branch that bears 1–3 sessile spikelets (Fig. 2 A, B & E). Each spikelet usually has two empty bracts or glumes, one sterile floret with reduced palea, one fertile floret and a rachilla extension bearing a reduced floret (Fig. 2 G, H & J).

Buds are not present in the axils of the bracts or glumes. This spikelet, when solitary at a node, bears a split prophyll at the base (Fig. 2 C & P). In the case of more than one spikelet (usually three) at a node, the branch bearing the terminal spikelet gives rise to a branch at each node below the lowermost glume; each such lateral branch, also terminated by a

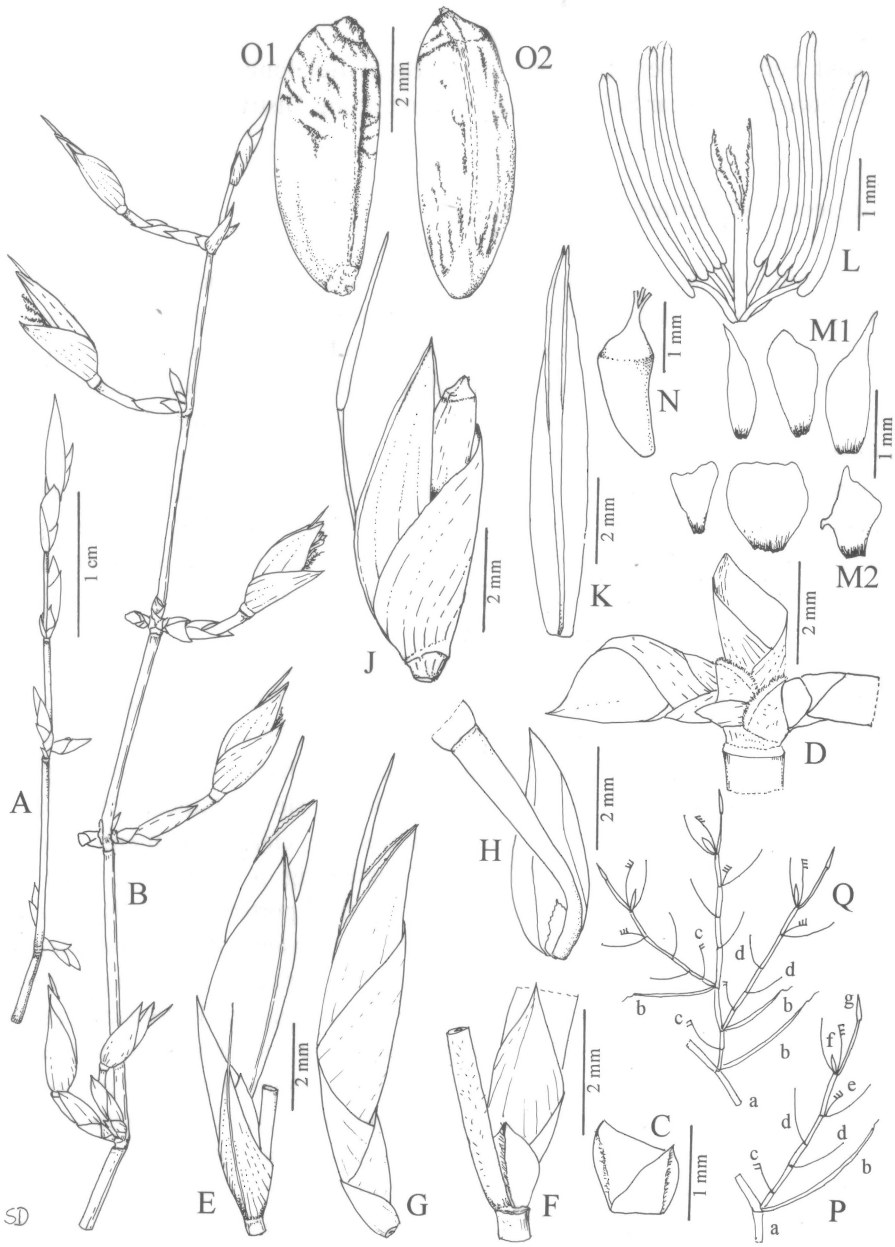

Fig. 2. *Temburongia simplex.* **A.** Young inflorescence. **B.** Older inflorescence, showing some mature spikelets and basal portions of some spikelets which have fallen away. **C.** Prophyll. **D.** Basal parts of a spikelet group of three. **E.** A node with a single spikelet, with a bract (or subtending sheath) still attached, and **F.** with bract removed. **G.** A young spikelet with two glumes (**d**). **H.** Sterile floret with elongated rachilla internode, showing lemma and reduced palea. **J.** Fertile floret with fruit and rachilla extension bearing rudimentary floret. **K.** Palea. **L.** Stamens and ovary. **M.** Lodicules of fertile floret, **M1** in young floret, **M2** in mature floret. **N.** Young fruit. **O.** Mature fruit. **P.** Diagram of **E**, a main axis node with one spikelet. **Q.** Diagram of **D**, a main axis node with three spikelets. (**a** = main axis, **b** = bract or subtending sheath, **c** = prophyll, **d** = glume, **e** = sterile (empty) floret, **f** = fertile floret, **g** = rachilla extension bearing rudimentary floret.) **A**–**N** from SD 1200, **O** from SD 1237. (Drawn by S. Dransfield.)

spikelet, is subtended by a sheath and has a split prophyll (Fig. 2 D & Q). Again, buds are not present at the base of these spikelets. The inflorescence, therefore, has a determinate nature, although the spikelets in the spikelet group may not necessarily mature simultaneously. In essence, the structure of each spikelet-bearing branch (or branch cluster) along the main inflorescence axis is homologous to that of a pseudospikelet (or pseudospikelet cluster) in an iterauctant inflorescence, except that buds are absent from the basal portion of the spikelets. This type of inflorescence has not been described before for any Malesian bamboo. The reason is that there has not been any comprehensive critical study of the structure of inflorescences in the bamboo genera occurring in the Old World, and in Malesia in particular. In the present situation it is almost impossible to relate this new genus to other Malesian bamboo genera. However, in inflorescence and spikelet structure *Temburongia* resembles *Greslania* from New Caledonia, which has semelauctant, or determinate, inflorescences with the presence of sheathing organs and prophylls. In *Greslania* the inflorescence is a panicle, and the spikelet consists of 3–5 transitional glumes, one perfect floret, and a rachilla extension bearing a rudimentary floret; the rachilla internode below the fertile floret does not elongate at maturity.

The new genus

Temburongia *S. Dransf. & K.M. Wong* **genus Graminearum–Bambusoidearum novum** *inflorescentia et structura spiculae distincta; inflorescentia determinata, ramum foliosum terminanti, segmentata, 3–5 internodiis, in quoque nodo bracteas et spiculas sessile ferenti; spicula base prophyllo minuto, flosculo imperfecto unico et flosculo hermaphrodito unico, internodio rachillae infra flosculum hermaphrodito elongato, extensione rachillae flosculum imperfectum ferenti; palea bicarinata, lemmatibus longior. Typus: T. simplex.*

Sympodial bamboo with erect and straight culms, and culm tips and branches scrambling or hanging over nearby vegetation or trees; culms of medium size, with relatively thin walls. Branch bud at each node, branches several with middle one dominant, elongating. Young shoots with glabrous culm leaves, sheath usually purplish green when young, blades erect. Leaf blades with very short petioles. Inflorescences terminating leafy branches, paniculate, determinate, main axis clearly segmented with 3–5 internodes, each node bearing a bract subtending a short unbranched axis with one sessile spikelet, or a short branched axis bearing three spikelets. Spikelets (other than those terminating the main axes) with very small prophylls at the base, prophyllated buds absent in the spikelets; two empty glumes, one imperfect floret, one hermaphrodite floret, and a rachilla extension bearing an imperfect floret; imperfect floret consisting of a lemma and a rudimentary palea; hermaphrodite floret consisting of lemma and palea, three lodicules, six stamens, glabrous ovary with long glabrous style and three hairy stigmas. Caryopsis oblong, with relatively thin pericarp not easily removed from the seed, seed with endosperm, and the embryo basal.

So far there is only one species known in the genus, found in the Temburong area, Brunei.

Fig. 3. Flowering branch of *Temburongia simplex.* (Photo by J. Dransfield.)

Temburongia simplex *S. Dransf. & K.M. Wong* **sp. nov.** *inflorescentia simplici, vaginis culmi auriculis rotundatis, vagina folii auricula rigida uno latere evoluta, 2–3 mm longa, inflorescentia 5 cm longa, 1–3 spicula in quoque nodo ferenti, spicula 2 glumas, minutas vacuas ferenti, flosculo hermaphrodito 3 lodiculis, fructu pericarpio tenuissimo distincta. Typus: Brunei, S. Dransfield SD 1200 (holotypus BRUN, isotypus K).* (Figs. 1–4)

Open tufted scrambling bamboo; culms about 10 m long, internodes 20–30 cm long, 0.7–3 cm in diameter, with walls 1 mm thick, with fine pale hairs becoming glabrous, pale green with white wax below nodes when young, nodes with patella; young shoots purplish green. Branch bud one at each node, branches several with middle branch dominant. Culm leaves with culm sheaths purplish green, glabrous, about 15.5 cm long, 4 cm wide in the middle, 1.5 cm wide at the top, the junction with the blade more or less horizontal; blades green, glabrous, erect, broadly lanceolate, up to 13 cm long, 1.8 cm near the base, 1.5 cm wide at the junction with the sheath, persistent; ligule very short, entire; auricles rounded, entire. Leafy branches 20–50 cm long, bearing 10–19 leaf-blades, blades 7–30 × 0.9–3.2 cm, with short petiole, base truncate, acuminate, finely short hairy below, glabrous above; sheaths glabrous; auricles undeveloped on one side, but in the form of a stiff lobe of 2–3 mm long on the other side. Inflorescence determinate, main axis clearly segmented, with sheaths and prophylls, up to 5 cm long, terminating leafy branches, with 3–5 internodes of 3–15 mm long (the length gradually decreasing toward the apex), each node bearing a lateral branch with one to three spikelets, each subtended by a sheath and possessing a split prophyll at the base. Spikelets glabrous, 7 mm long when young, about 17 mm at maturity, consisting of 2 (rarely 3) small empty glumes, one empty (reduced) floret, one fertile floret, and a rachilla extension bearing a reduced floret, rachilla internodes short, except that below fertile spikelet which elongates at maturity, up to 3 mm long; rachilla extension 8 mm long in mature spikelet, glabrous, slender; lemma glabrous, about 7 mm long, obtuse; palea glabrous, 8.5 mm long in mature floret, 2-keeled; lodicules 3, ovate with long narrow tips in young floret, with blunt tips in mature floret; stamens 6, filaments free, anthers with 2 short pointed tips; ovary slender, glabrous, with elongated style, stigmas 3. Caryopsis green when fresh, oblique, 4–5 mm long, with very thin pericarp not easily separated from the seed.

DISTRIBUTION. So far found only in Temburong (Temburong river and Belalong river up to Bukit Belalong), Brunei.

HABITAT. In primary forest on river banks or hill slopes, from 50 m to 900 m.

SPECIMENS EXAMINED—BORNEO. BRUNEI: Temburong River at Kuala Belalong, *Wong s.n.* 22 July 1988, sterile (BRUN, K); 20 June 1989, fl., *Wong* WKM 1152; 24 June 1989, fl., *Dransfield* SD 1014 (BRUN, K); 25 June 1989, fl., *Dransfield et al.* SD 1029 (BRUN, K); 10 February 1990, fl., *Wong* WKM 1641 (BRUN, K); 13 February 1992, fl., *Dransfield et al.* SD 1200 (BRUN, K); 15 February 1992, aerial roots, *Dransfield et al.* SD 1205 (K); Bukit Belalong, 22 February 1992, fl. & fr., *Dransfield et al.* SD 1234 (BRUN,

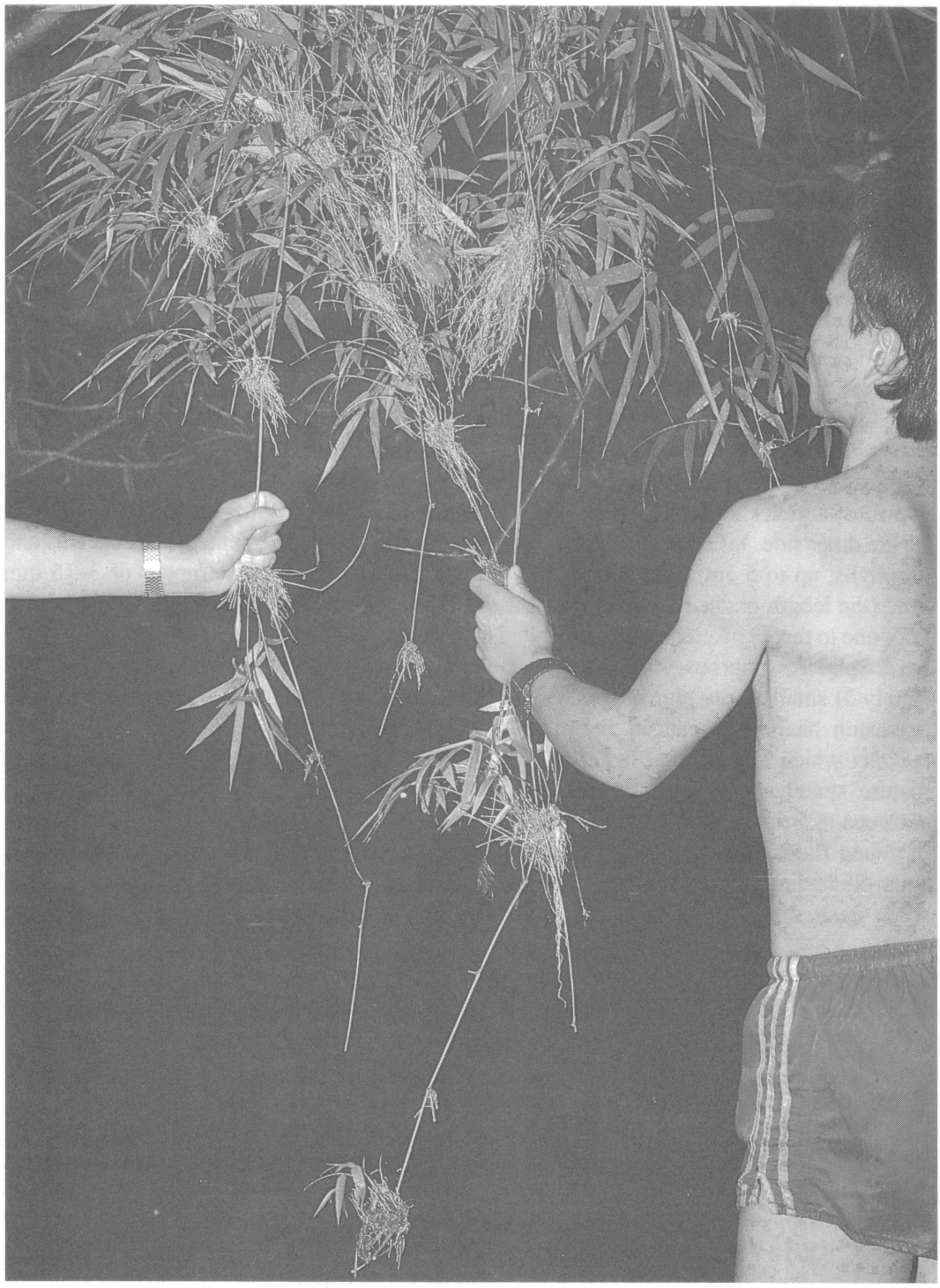

Fig. 4. Hanging apical portions of culms of *Temburongia simplex*, the nodes with branch complements that have developed abundant aerial roots at the branch bases. (Photo by K.M. Wong.)

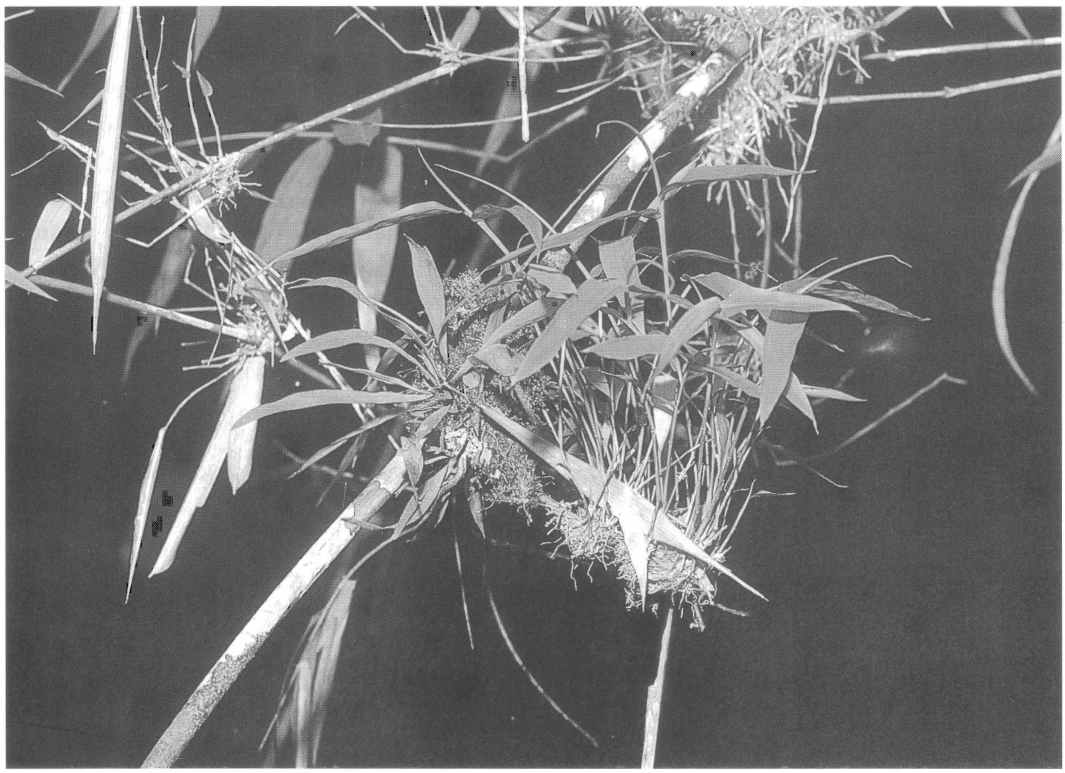

Fig. 5. Close-up view of root-bearing branch complements along an apical hanging portion of a culm of *Temburongia simplex*. (Photo by K.M. Wong.)

K); 25 February 1992, fl. & fr., *Dransfield et al.* SD 1255 (BRUN, K); Wong Nguan gorge, 10 April 1990, fl., *Wong* WKM 1740 (BRUN); Ulu Belalong, 17 January 1994, fl., *Dransfield et al.* JD 7348 (BRUN, K); Batu Apoi, Selapon, 30 January 1994, fl., *Dransfield et al.* JD 7490 (BRUN, K).

Like many other scrambling bamboos, in *Temburongia simplex* the upper (apical) parts of the main branches or main culms scramble over or lean on nearby vegetation or hang. However, in this species, it is interesting to note that the upper nodes of these branches and culm portions have branch complements that often produce many slender branched aerial roots, and that the tips of such branches and culms have been damaged (Fig. 4 & 5), possibly by the effect of floods. Such hanging branches or culm portions can be seen along the rocky banks of both the Sungai Temburong and the Sungai Belalong. During floods it is possible that these rooting nodes will be broken off, and carried down the river, and perhaps deposited on river banks. Such fragments might then grow and establish new clumps. This may be a way by which the bamboo is dispersed. So far, this situation has not been recorded in other bamboos. It has also been noticed that hanging branches without aerial roots also have undamaged tips. Limited observations also reveal that plants found growing away from the river (somewhat less common) do not behave in this way.

ACKNOWLEDGEMENTS

Fieldwork was supported by the Brunei Forestry Department, the Universiti Brunei Darussalam, the Royal Brunei Air Force and the Royal Botanic Gardens, Kew, U.K. We would like to thank the Forestry Department staff in Sungai Liang, Brunei, and Dr Kamariah Abu Salim of the university's Biology Department for valuable logistic help, especially in the field. Dr John Dransfield provided valuable comments on an early version of this manuscript. We are especially grateful to Haji Mohammad Yassin Bin Ampuan Salleh, Director of the Brunei Forestry Department, for his encouragement of such studies.

REFERENCES

Dransfield, S. (1994) The genus *Hickelia* (Gramineae–Bambusoideae). Kew Bull. 49(3): 429–443.

McClure, F.A. (1966) The Bamboos. A Fresh Perspective. Harvard University Press: Cambridge, Massachussetts.